Quadrilaterals

Brief Overview:

For the next three days students will become familiar with properties of quadrilaterals. Through exploration students will use geo-boards to manipulate different properties of quadrilaterals. In addition to communicating their ideas through oral and written responses, they will work in cooperative heterogeneous groups to create resources that reinforce specific concepts. Lessons are organized to provide the teacher with an assortment of varied assessments to enhance student achievement.

NCTM Content Standard/National Science Education Standard**:**

Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships

- **Identify, compare, and analyze attributes of two- and three-dimensional shapes and develop vocabulary to describe the attributes.**

Grade/Level:

Lessons are appropriate for Grades 3 and 4

Duration/Length:

3 days, given that each math block is 60 minutes long

Student Outcomes:

Students will:

- **Analyze and identify the different properties of quadrilateral polygons**

Materials and Resources:

- **Student Resources 1-7**
- **Teacher Resources 1-5**
- **Geo-board (with bands) for each student**
- **6 pieces of cardstock - 8 .5" by 11"**
- **Color pencils, markers and/or crayons**
- **Construction paper of different colors**
- **White computer paper**
- **Envelopes**
- **Index cards**
- **Scissors**

- **Glue/tape**
- **Chart paper**
- **Pattern blocks**

Development/Procedures:

Lesson 1

Pre-Assessment/Launch –

Before assessment, prepare Student Resource 1, by copying onto colored paper, cutting out shapes, and placing them in bags. Each group of students will receive a bag of quadrilaterals.

- **Say, "Today in math we are going to explore different shapes. Your group has a bag of shapes. I would like you to observe and discuss how the shapes are alike. Be prepared to share observations." As students are working circulate around the room to informally assess student learning and make sure students are on task. Allow five minutes for exploration.**
- **Invite students to share group observations and record their responses on a piece of 8.5" x 11" card stock. This paper will be the quadrilateral section of a larger diagram showing the connection between the various types of quadrilaterals (see Teacher Resource 1). If students fail to make accurate observations, guide students by asking the following questions: How many sides do all the shapes have? Are the sides straight or curved? What do we call a shape with four straight sides? Upon completion of opening activity students should have arrived at the conclusion that all the shapes are quadrilaterals.**
- **Tell students they have just discovered the properties of quadrilaterals. Quadrilaterals are polygons composed of four straight-line segments.**

Teacher Facilitation –

Ensure that each student has a geo-board and bands, two-color pencils, and booklet (Student Resource 2). See Teacher Resource 2 to see how to fold and cut the booklet. On large chart paper prepare a model of the booklet. During this activity review geometry vocabulary, allow students to create quadrilaterals on geo-boards, and guide students in creating a booklet.

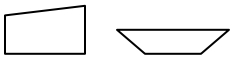
- **Instruct students to use their geo-boards to create a right angle. Students may work with their group to share ideas. After a minute ask students to hold up their geo-boards. Ensure all students can create a right angle and explain that a right angle is like the angle at the corner of your paper. Next ask students to**

clear their boards. Continue reviewing by asking students to create congruent lines, one set of parallel lines, and then two sets of parallel lines. Check to make sure students demonstrate that congruent lines are the same length and that a set of parallel lines is equal distance apart and will never cross. Key vocabulary and definitions may be recorded on the board.

Student Application –

Student application occurs with teacher facilitation. Guide students as they create their booklets (Student Resource 2).

- **Inform students that they are now ready to create the quadrilaterals on their geo-board. Again identify the properties of quadrilaterals to reinforce this concept.**
- **Instruct students to work with their group members to create a quadrilateral with exactly one set of parallel lines.**
- **Allow time for groups to explore together to figure out how this will look. Then invite students to share their creations. Ensure that student have a four sided shape with exactly one set of parallel lines. Ask: "Does anyone know what we call a special quadrilateral with exactly one set of parallel lines?" (A trapezoid)**
- **Use the large model on chart paper to show the students how to record their trapezoid on the booklet. On the first flap they will use the geo dots to record their shape. Then they will lift up the flap and write "trapezoid – a quadrilateral with exactly one set of parallel lines". Instruct students to use a colored pencil or marker to highlight the set of parallel lines on the trapezoid drawn on the dot paper. This emphasizes trapezoids have exactly one set of parallel lines. (Note there are two types of trapezoids. Make sure students are shown both types and record both on separate flaps in the booklet.)**
  Examples:



- **Continue to instruct students to create specific types of quadrilaterals and then model how to record them on the booklet. When the students record a shape with two sets of parallel lines, highlight each set of parallel lines in a different color. Right angles and congruent sides my also be highlighted. Students will create the following:**
  - **A quadrilateral with two sets of parallel lines (parallelogram)**
  - **A quadrilateral with two sets of parallel lines and congruent sides (rhombus)**

- **A quadrilateral with two sets of parallel lines, and right angles (rectangle or square)**
- **A quadrilateral with two sets of parallel lines, right angles and congruent sides (square)**

Embedded Assessment –

During the last 5 minutes of class, distribute the exit ticket (Student Resource 3). Working independently, students may use the booklet to complete the exit ticket. This formative assessment will show if the students are able to identify a quadrilateral and explain its properties. Answer key can be found on Teacher Resource 3.

Reteaching/Extension –

- **Extension: Allow students to practice matching quadrilaterals with their properties. When students visit this site, they will select the one figure that does not satisfy each of the set of properties and check their answers. http://teams.lacoe.edu/documentation/classrooms/amy/geometry/3-4/activities/new_quads/quads.html**
- **Reteach: Provide review of quadrilaterals and their properties by allowing students to independently visit the following website http://www.math.com/school/subject3/lessons/S3U2L3GL.html**

Lesson 2

Pre-Assessment/Launch –

Prepare a bag for each student with all of the pattern block shapes including the triangle, hexagon, square, parallelogram/rhombus, and trapezoid.

- **Instruct students to show their understanding of quadrilaterals by placing all the quadrilaterals on their nametag and all other polygons back in the bag. This activity is a quick way to assess that the students know a square, parallelogram/rhombus, trapezoid are quadrilaterals and triangles and hexagons are not. If you do not see the correct outcome have students use the booklet made yesterday to help them.**

Teacher Facilitation – **Cut out the five shapes from Student Resource 4a-c on construction paper and clip each one to an envelope. These shapes will be used for a "pass the problem activity."**

- **Give each cooperative group five index cards and one envelope with attached shape (differentiate by passing out shapes according to group ability – the easiest shape will be a trapezoid the most difficult will be a square). Each group will have one minute to list on one index card as many properties or observations as they can (students in each group may work together). After one minute, the group will put the index card they were using in the envelope and pass it clockwise to the next group. Now each group has a new envelope with attached shape. They will describe the new shape without looking at what is already in the envelope. Passing and recording will continue until groups have seen all shapes and there original shape is passed back to them.**

Student Application – **Using the pass the problem activity, students will create a poster on 8.5" x 12" card stock. This poster will identify the properties of their given quadrilateral. They may now look at all the index cards in the envelope and decide what important information to place on their poster. After ten minutes groups will share their posters.**

- **Distribute markers and card stock. Allow students to read and analyze the information on the index cards from the pass the problem activity. Students will work cooperatively to identify the properties to include on the poster. Let students work for approximately 10 minutes.**
- **Invite groups to share their posters in the following order: trapezoid, parallelogram, rectangle, rhombus, square. Use Teacher Resource 1 as a guide to show how to place posters on chalkboards with tape after presented. After all groups share and the posters are arranged, emphasize the similarities of shapes through questioning and student discussion. Ask questions such as: "What is the difference between a trapezoid and the rest of the quadrilaterals?" Trapezoids are different because they have exactly one set of parallel lines and the others have two sets. Hold up a square. Ask, "What can we call this polygon?" Help students realize a square has the properties of a square, rhombus, rectangle, and parallelogram. It can be called any of these names.**

Embedded Assessment –

Cut out shapes from Student Resource 5 and give one shape to each student or pairs of students depending on class size. Students will hold up shapes based on directions. Ask students to explain the properties.

- **Ask students to hold up their shape if they have….**

- **A polygon (everyone should raise their shape). Call on a volunteer to give the properties of a polygon (closed figure with straight lines).**
- **A quadrilateral (everyone should raise their shape). Call on a volunteer to give the properties of a quadrilateral (polygon made of 4 straight line segments).**
- **A parallelogram (reference Teacher Resource 1 for answer)**
- **A square (reference Teacher Resource 1 for answer)**
- **A rectangle (reference Teacher Resource 1 for answer)**
- **A rhombus (reference Teacher Resource 1 for answer)**
- **A trapezoid (reference Teacher Resource 1 for answer)**

Reteaching/Extension –

- **Extension: Provide students with shapes from Student Resource 5 and challenge them to categorize the shapes onto the posters created in this lesson. Hint congruent shapes will not appear on individual posters. (Reference Teacher Resource 1 for answer)**
- **Reteach: Play quad card game with a partner to reinforce specific properties of quadrilaterals. Directions and pre-made cards are available on Student Resource 6.**

Lesson 3

Pre-Assessment/Launch –

This part of the lesson should take no longer than 15 minutes.

- **Prompt the students and say, "What concept have we been exploring during the past two days?" Call on a volunteer to answer. Student should respond and say polygons and quadrilateral properties (make sure students know vocabulary of each quadrilateral and more specifically the word property).**
- **Introduce today's activity. Say: "Today we are going to be math experts by making a game to review quadrilateral properties. Before we do this, I want to quiz you on what you know about geometric shapes!"**
- **Model an example of a riddle allowing students to draw the shape. Give them an example of a riddle such as "I am a polygon. All of my sides are congruent. If you cut me in half, I will become two rectangles. I have 4 right angles. What am I? (square) If students are struggling you may want students to choose an object in the room to describe using adjectives.**
  - **Allow students to work with a partner to create their own riddle about a shape. Say: "I want you to practice making riddles with your partner. Think of a flat shape that you could create a riddle for." You might want to write the original modeled riddle on the**

board for visual assistance. Allow time for students to work together. Make sure you ask questions such as, "What clues did you use to create your riddle? Why did you use those specific properties? What could you eliminate or add to make your riddle harder or easier?"

Teacher Facilitation – **Have a prepared paper fortuneteller on hand to show students an example of what they will be constructing. They are easy and kid friendly to make. You will be surprised that some of your students will already know how to fold the paper to make the fortuneteller. To find and print out easy directions go to http://www.enchantedlearning.com/crafts/origami/fortuneteller/. On the outside of the fortune teller students will label with different polygon names instead of colors. Students will also write riddles where the "fortune" part would be. Students will still label the inside with numbers. This part of the lesson should take 10 minutes to construct.**

- **Engage students by flipping through the fortuneteller. Ask students what we might be making these for? Say: "Could anyone guess why we might be making fortune tellers in math?" Help students realize that they will be using this fortuneteller to quiz classmates about quadrilaterals!**

Student Application –

Students should have a completely folded fortuneteller. At this time students will be able to design the fortuneteller. Emphasize the importance of writing the riddles first inside the fortuneteller. Students should take no longer than 20 minutes to design the fortuneteller.

- **Direct students to label the outside portion of the fortune teller with polygon vocabulary and NOT COLORS: quadrilateral, parallelogram, trapezoid, rectangle, rhombus, square, polygon, right angle, congruent, line segment, parallel, etc. Follow the website directions to label the inside with numbers.**
- **Allow time for students to formulate riddles about quadrilaterals. If students are struggling direct them to the posters from yesterday and the study guide they made on the first day.**

Embedded Assessment – **Make sure students have completed fortunetellers. You could ask the students to also write the answer to the riddle in the space on the fortuneteller, which could be a way to assess students if you collect the fortunetellers.**

Direct students who have completed fortunetellers to quiz classmates around the room.

- **Circulate around the room and praise different students with the riddles they developed. You may even want to construct a fortuneteller for future warm-ups and reviews and use student created riddles you hear while you observe.**
- **Have students return to their desks and use the teacher fortuneteller to have students solve a final riddle before the math time is over. They can write the answer on notebook paper, or anything handy. Just make sure to call on a student volunteer to go through the process of choosing a riddle from the teller.**
- **Determine the correct answer as a class.**

Reteaching/Extension –

- **Extension: Challenge students to a multiple choice online quiz. Keep in mind some concepts are** not **covered within these 3 days. Geometric concepts included in the website are area, perimeter, quadrilaterals and much more.**
  http://www.regentsprep.org/Regents/math/quad/PracQuad.htm

- **Reteach and review by playing an electronic hangman game dealing with quadrilateral concepts. http://www.quia.com/hm/95871.html**

Summative Assessment**:**

Students will demonstrate mastery of quadrilateral properties by taking a summative assessment (Student Resource 7). This assessment allows students to analyze quadrilaterals and use embedded vocabulary to show understanding of concept. Teacher Resource 5 can be used at your discretion throughout the lesson to record individual student achievement. Answers can be found on Teacher Resource 4.

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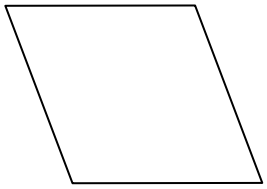
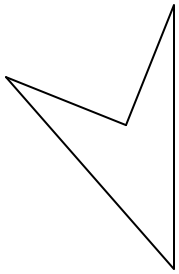
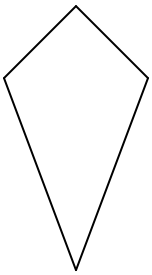
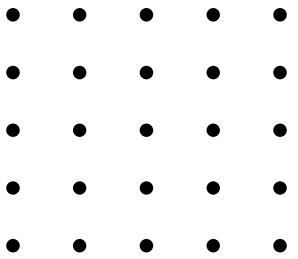
Student Resource 1

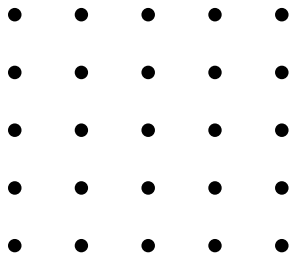


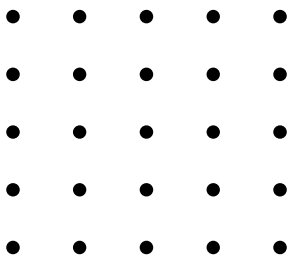






Cut here

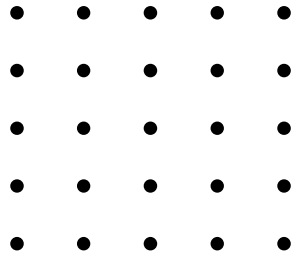


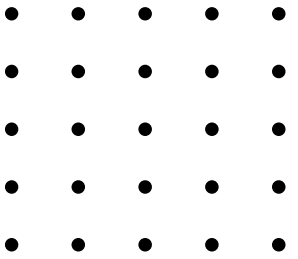


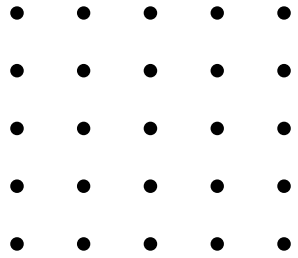
Student Resource 2

_____'s

Quadrilateral
Booklet





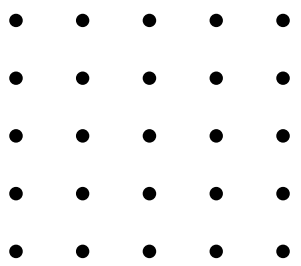


Student Resource 3

Exit Ticket- Day 1

Name: _____Date: _____

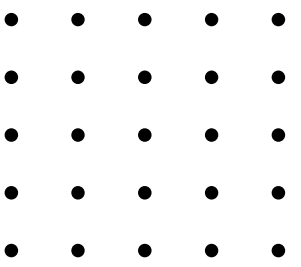
Directions: Draw your favorite quadrilateral on the dot paper. Write the correct name and properties of your shape.

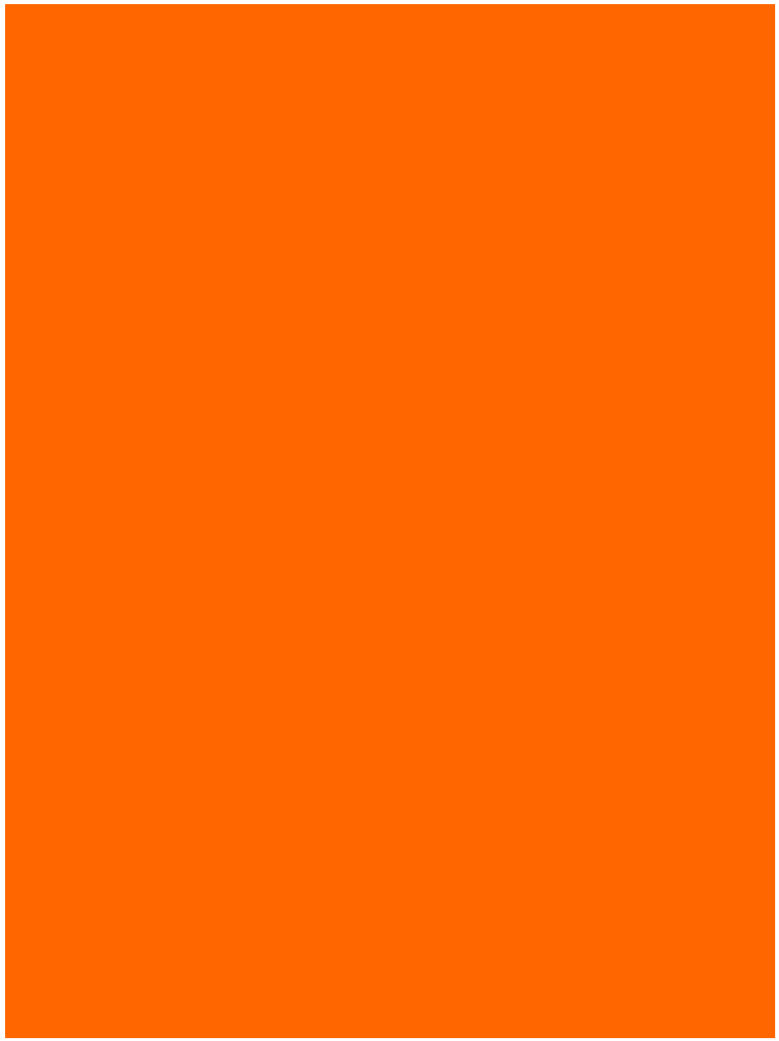
	**Name of quadrilateral:** _____ _____ **Properties:** _____ _____ _____- _____

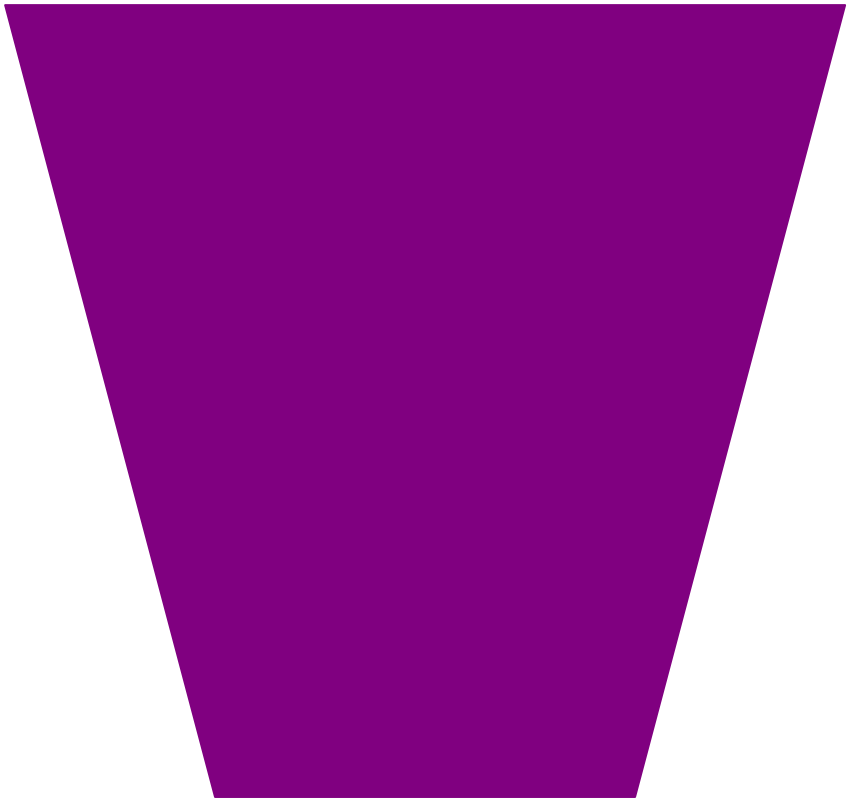
Exit Ticket- Day 1

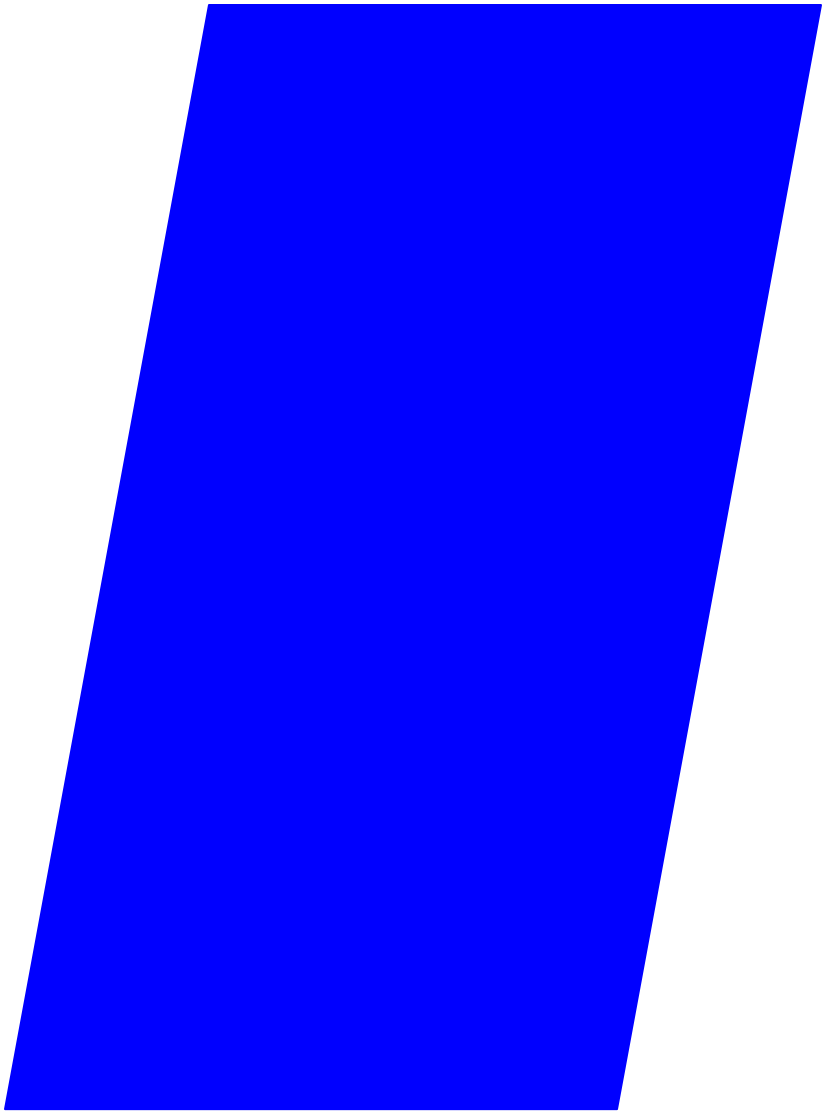
Name: _____Date: _____

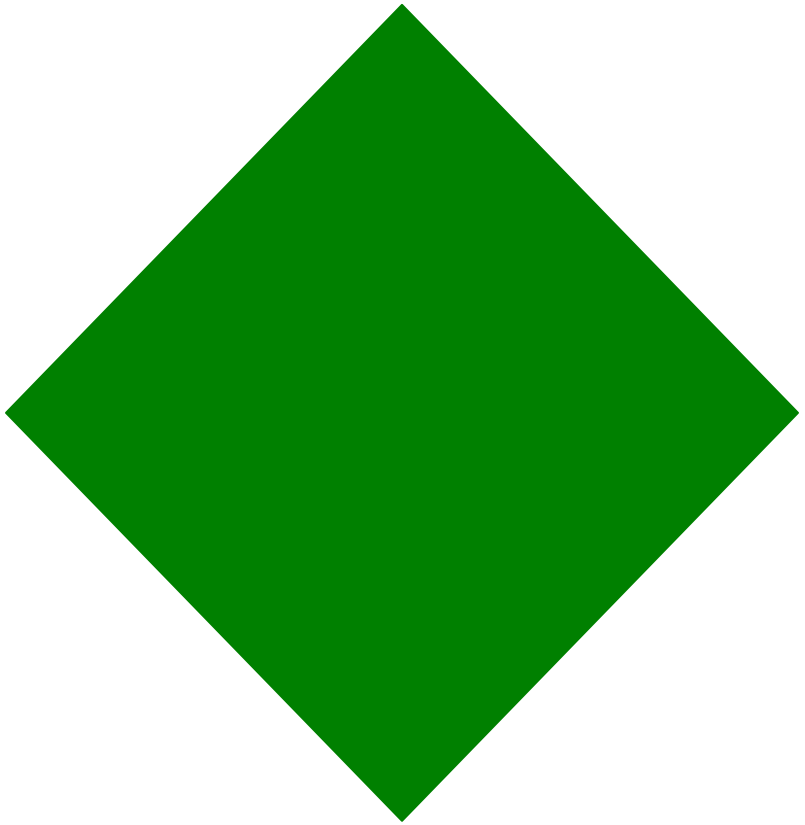
Directions: Draw your favorite quadrilateral on the dot paper. Write the correct name and properties of your shape.

	**Name of quadrilateral:** _____ _____ **Properties:** _____ _____ _____ _____

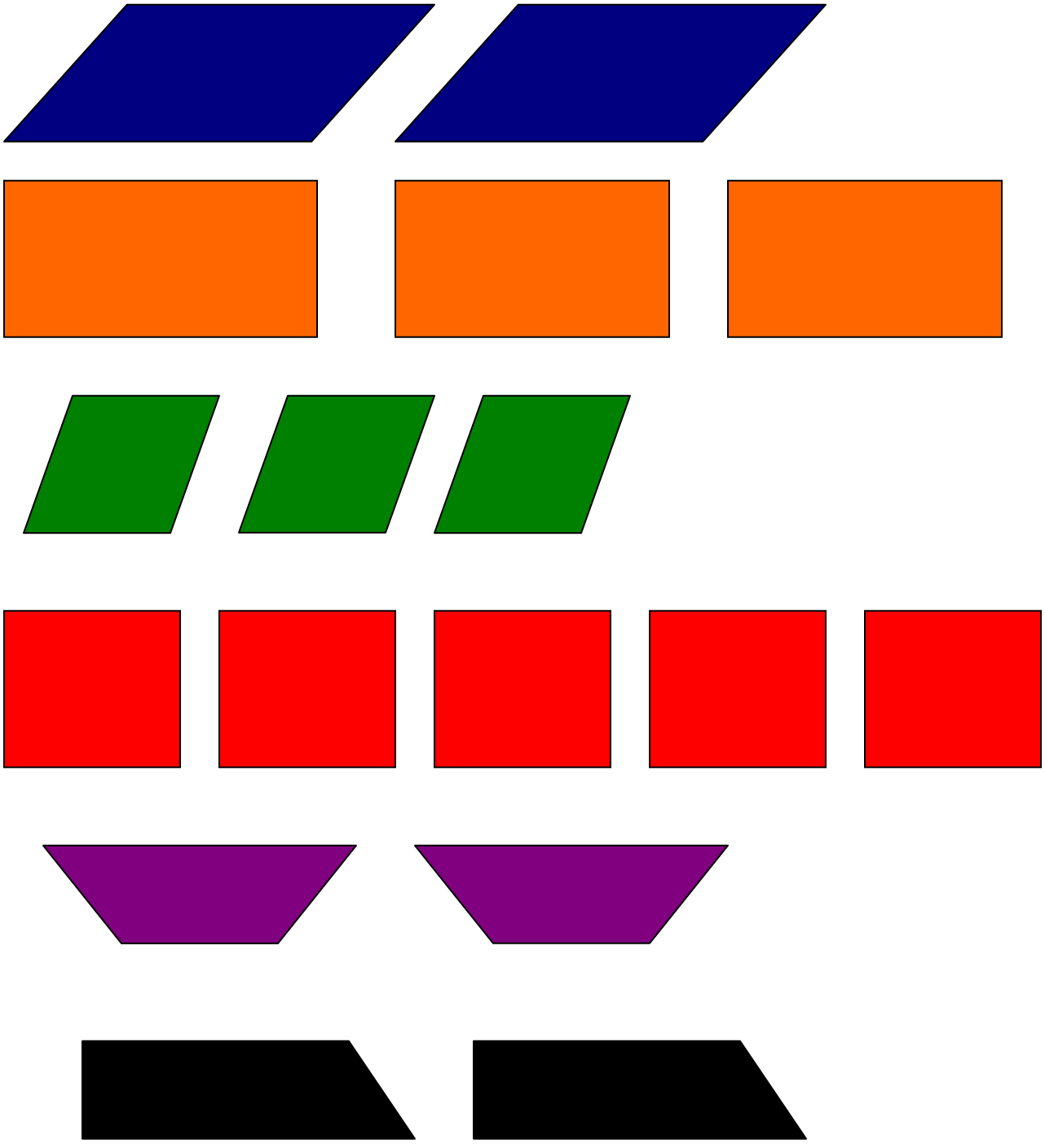


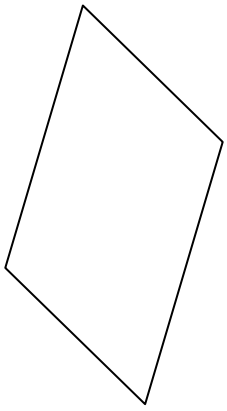
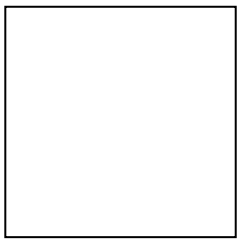
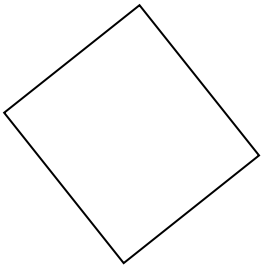


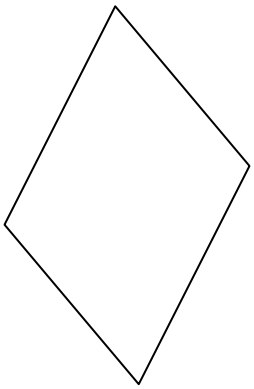
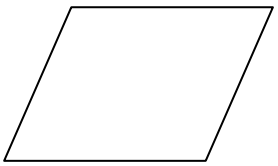
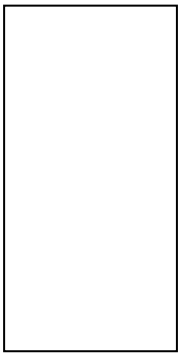


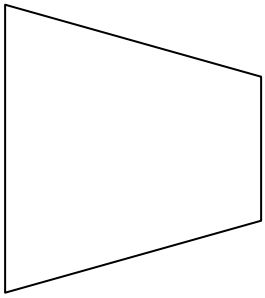
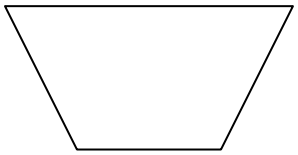


Student Resource 5
Smaller Shapes for lesson 2

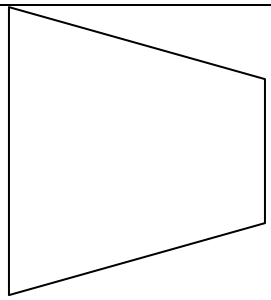
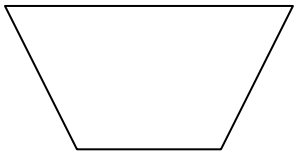


	parallelogram 	**opposite sides are <u>equal</u> and <u>parallel</u>**
	**square** 	**four <u>right</u> <u>angles</u> and four <u>equal</u> sides**

	**rhombus** 	**a <u>parallelogram</u> with 4 <u>equal</u> sides**
	**rectangle** 	**four <u>right angles</u> and <u>equal</u> <u>opposite</u> sides**

	**trapezoid** 	**<u>exactly</u> one pair of parallel sides**

Directions for matching activity:
Copy cards onto card stock, cut out.
Mix up cards and place cards face down.
Students should match three like cards in order to have a complete match. For example,

	**trapezoid** 	**<u>exactly</u> one pair of parallel sides**

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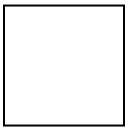
Student Resource 7

Summative Assessment

Name: _____ Date: _____

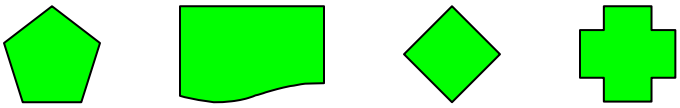
Directions: Read the question and circle the best answer.

1.) Which word does not describe the polygon below?



a.) square
b.)rectangle
c.) rhombus
d.)trapezoid

Part A **Look at the shapes below and circle the quadrilateral.**



Part B **Use what you know about** quadrilaterals **to explain why your answer is correct. Use words, numbers and/or pictures in your response.**

_____

_____

_____

_____

_____

_____

_____

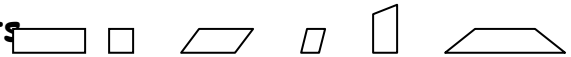
POLYGONS

Closed figure made up of straight-line segments

QUADRILATERAL

Closed figure made up of straight-line segments (polygon)

4 line segments



PARALLELLOGRAM

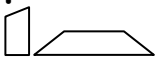
Polygon with 4 sides

2 pairs of parallel sides

TRAPEZOID

Polygon with 4 sides

exactly one pair of parallel sides



RECTANGLE

Polygon with 4 sides

2 pairs of parallel sides

4 right angles

RHOMBUS

4 sides

2 pairs of parallel sides

All sides congruent

SQUARE

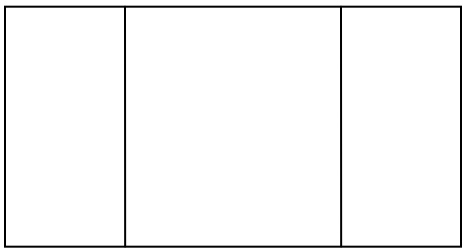
Polygon with 4 sides

2 pairs of parallel sides

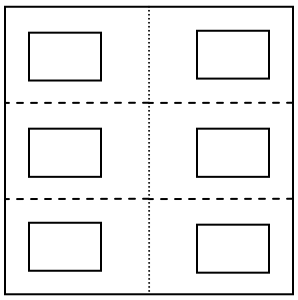
4 right angles

All sides congruent

Teacher Resource 2



1. **Turn paper on to blank side, horizontally.**
2. **Fold left side of paper inwards and crease at solid line. Do the same for right side of paper.**
3. **Make sure the flaps on each side fold in to a meeting point, showing the geometric dots.**

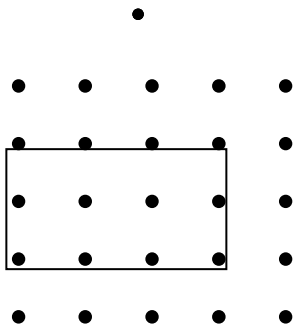


Booklet should have two flaps to open up on both sides.
Student will cut on dotted lines when

Student Sample Response
Exit Ticket- Day 1

Name: _____ Date: _____

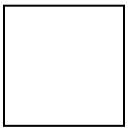
Directions: Draw your favorite quadrilateral on the dot paper. Write the correct name and properties of your shape.

	**Name of quadrilateral:** Rectangle **Properties:** Polygon with 4 sides, 2 pairs of parallel lines, and 4 right angles.

****For additional information please reference Teacher Resource 1**

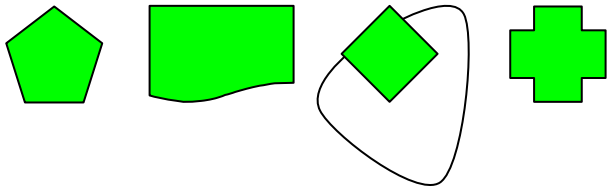
Sample Student Response

1.) Which word does not describe the polygon below?



a.) square
b.) rectangle
c.) rhombus
d.) trapezoid

Part A Look at the shapes below and circle the quadrilateral.



Part B Use what you know about quadrilaterals **to explain why your answer is correct. Use words, numbers and/or pictures in your response.**

The shape that I circled is the only possible polygon that is a quadrilateral. Quadrilaterals have four straight-line segments. All polygons are made up of only straight-line segments so I knew that the shape to the right of the pentagon would never have polygon or quadrilateral properties. As for the pentagon and cross shape, they have more than four straight-lines that would categorize them as polygons but not quadrilaterals. Therefore, the square shape is the correct choice because it has four straight-line segments.

**** If you are a teacher in Maryland we provided a box for students to write in, to prepare them for the MSA format. The answers can be adjusted to fit the needs of your students, just make sure they are answering why and how in all responses. ****

Teacher Resource 5

Student Name	Able to define Quadrilateral	Able to recognize quadrilateral properties of a . . .				
		Parallelogram	Trapezoid	Rectangle	Rhombus	Square